

Claims

- [c1] 1. A method for producing a plant characterized by reversible male-sterility comprising transforming a plant cell with a nucleic acid construct containing a polynucleotide encoding a *gai* gene, a regulatory sequence, and transcription termination sequence and regenerating a plant from said plant cell wherein expression of said *gai* gene inhibits pollen formation in said plant.
- [c2] 2. The method of claim 1, wherein said regulatory sequence is selected from the group consisting of constitutive, inducible, environmentally regulated, developmentally regulated, organelle-specific, cell-specific, tissue-specific, male specific, anther-specific, pollen-specific, stamen-specific, tapetum-specific promoters and any combination thereof.
- [c3] 3. The method of claim 2, wherein said promoter is a pollen-specific promoter.
- [c4] 4. The method of claim 2, wherein said promoter is an anther-specific promoter.
- [c5] 5. A method for producing a plant characterized by reversible male-sterility comprising transforming a plant cell with a nucleic acid construct containing a polynucleotide encoding a *gai* gene, a regulatory sequence, and transcription termination sequence; regenerating a plant from said plant cell wherein expression of said *gai* gene inhibits pollen formation in said plant; and restoring male-fertility by application of a composition comprising cytokinin.
- [c6] 6. The method of claim 5, wherein said composition further comprises a surfactant.
- [c7] 7. The method of claim 5, wherein said cytokinin comprises kinetin.
- [c8] 8. The method of claim 7, wherein kinetin is applied at between about 1 mg/plant to about 50 mg/plant.
- [c9] 9. The method of claim 7, wherein kinetin is applied at between about 10 mg/plant to about 15 mg/plant.
- [c10] 10. The method of claim 5, wherein said composition is applied prior to development of the male tissues.

- [c11] 11. The method of claim 5, wherein said composition is applied during the development of male tissues.
- [c12] 12. The method of claim 1, further comprising transforming said plant cell with a nucleic acid construct comprising an inducible promoter and a transcription termination sequence both operably linked to an antisense construct wherein expression of said antisense construct suppresses expression of said *gai* gene.
- [c13] 13. A method for producing a plant characterized by reversible male-sterility comprising transforming a plant cell with a nucleic acid construct containing a polynucleotide encoding a *gai* gene, a regulatory sequence, and transcription termination sequence; regenerating a plant from said plant cell wherein expression of said *gai* gene inhibits pollen formation in said plant; sexually crossing said plant comprising said polynucleotide encoding a *gai* gene with a plant of the same variety comprising a nucleic acid construct containing an inducible promoter and a transcription termination sequence both operably linked to an antisense construct wherein expression of said antisense construct suppresses expression of said *gai* gene.
- [c14] 14. The method of claim 13, wherein male-fertility is restored by expression of said antisense construct.
- [c15] 15. The method of claim 1, further comprising transforming said plant cell with a nucleic acid construct comprising an inducible promoter and a transcription termination sequence both operably linked to polynucleotide encoding a dominant negative mutant protein, wherein expression of said dominant negative mutant results in decreased expression or activity of said *gai* gene.
- [c16] 16. The method of claim 1, further comprising sexually crossing said plant comprising said polynucleotide encoding a *gai* gene with a plant of the same variety comprising an inducible promoter and a transcription termination sequence both operably linked to polynucleotide encoding a dominant negative mutant protein, wherein expression of said dominant negative mutant results in decreased expression or activity of said *gai*

gene.

- [c17] 17. The method of claim 16, wherein male-fertility is restored by expression of said dominant negative mutant protein.
- [c18] 18. The method of claim 1, further comprising transforming said plant cell with a nucleic acid construct comprising an inducible promoter and a transcription termination sequence both operably linked to a polynucleotide encoding a ribozyme wherein expression of said ribozyme suppresses expression of said *gai* gene.
- [c19] 19. A method for producing a plant characterized by reversible male-sterility comprising transforming a plant cell with a nucleic acid construct containing a polynucleotide encoding a *gai* gene, a regulatory sequence, and transcription termination sequence; regenerating a plant from said plant cell wherein expression of said *gai* gene inhibits pollen formation in said plant; and sexually crossing said plant comprising said polynucleotide encoding a *gai* gene with a plant of the same variety comprising a nucleic acid construct containing an inducible promoter and a transcription termination sequence both operably linked to a polynucleotide encoding a ribozyme, wherein expression of said ribozyme suppresses expression of said *gai* gene.
- [c20] 20. A method for producing a plant characterized by reversible male-sterility comprising transforming a plant cell with a nucleic acid construct containing a polynucleotide encoding a *gai* gene, a regulatory sequence, and transcription termination sequence; regenerating a plant from said plant cell wherein expression of said *gai* gene inhibits pollen formation in said plant; and selfing said plant to produce a plant homozygous for said polynucleotide encoding a *gai* gene.
- [c21] 21. A seed from a plant produced by the method of any of the preceding claims.
- [c22] 22. A uniform population of plants produced by the method of any of claims 1-20.

- [c23] 23. A method of producing a hybrid plant comprising sexually crossing a plant produced by the method of any of claims 1–22 with a plant of the same species having a different genetic makeup.
- [c24] 24. A hybrid plant produced by the method of claim 23.
- [c25] 25. A seed produced from the plant of claim 23.
- [c26] 26. A method for preventing or reducing the pollination of plants with pollen containing a transgene comprising:
a) interplanting,
1) a transgenic, male–sterile plant containing, in addition to at least one transgene, a nucleic acid construct encoding a *gai* gene, wherein said male–sterility is due to expression of said *gai* gene, and
2) a plant of the same or different variety as the plant in 1) that is not transgenic; and
b) allowing the plants of 2) to pollinate the plants of 1).
- [c27] 27. The method of claim 1, wherein said *gai* gene is an anther–expressed *gai* gene.
- [c28] 28. The method of claim 1, wherein said male–sterility is reversible.
- [c29] 29. The method of claim 28, wherein said reversibly male–sterile plant is produced by the method of any of claims 1–20.
- [c30] 30. A method for preventing or reducing the pollination of plants with pollen containing a transgene comprising obtaining a plant hemizygous for a pollen expressed *gai* gene linked to at least one transgene wherein expression of said *gai* gene results in male sterility; and growing said plant.
- [c31] 31. The method of claim 30, wherein said plant is obtained by crossing a plant homozygous for said pollen–expressed *gai* gene linked to at least one transgene to a non–transgenic plant.
- [c32] 32. A method for producing a grain or plants with an economically important transgenic or non–transgenic trait comprising interplanting (a) an agronomically

desirable plant wherein said plant has been made reversibly male-sterile by the method of any of claims 1-20, and (b) a plant possessing an economically desirable trait; and allowing the plants of (b) to pollinate the plants of (a).

[c33] 33.The method of claim 32, wherein the plant of (a) is an elite hybrid variety.

[c34] 34.The method of claim 32, wherein the plant of (b) is interplanted at a low density.

[c35] 35.A transgenic corn plant comprising the *gai* gene.